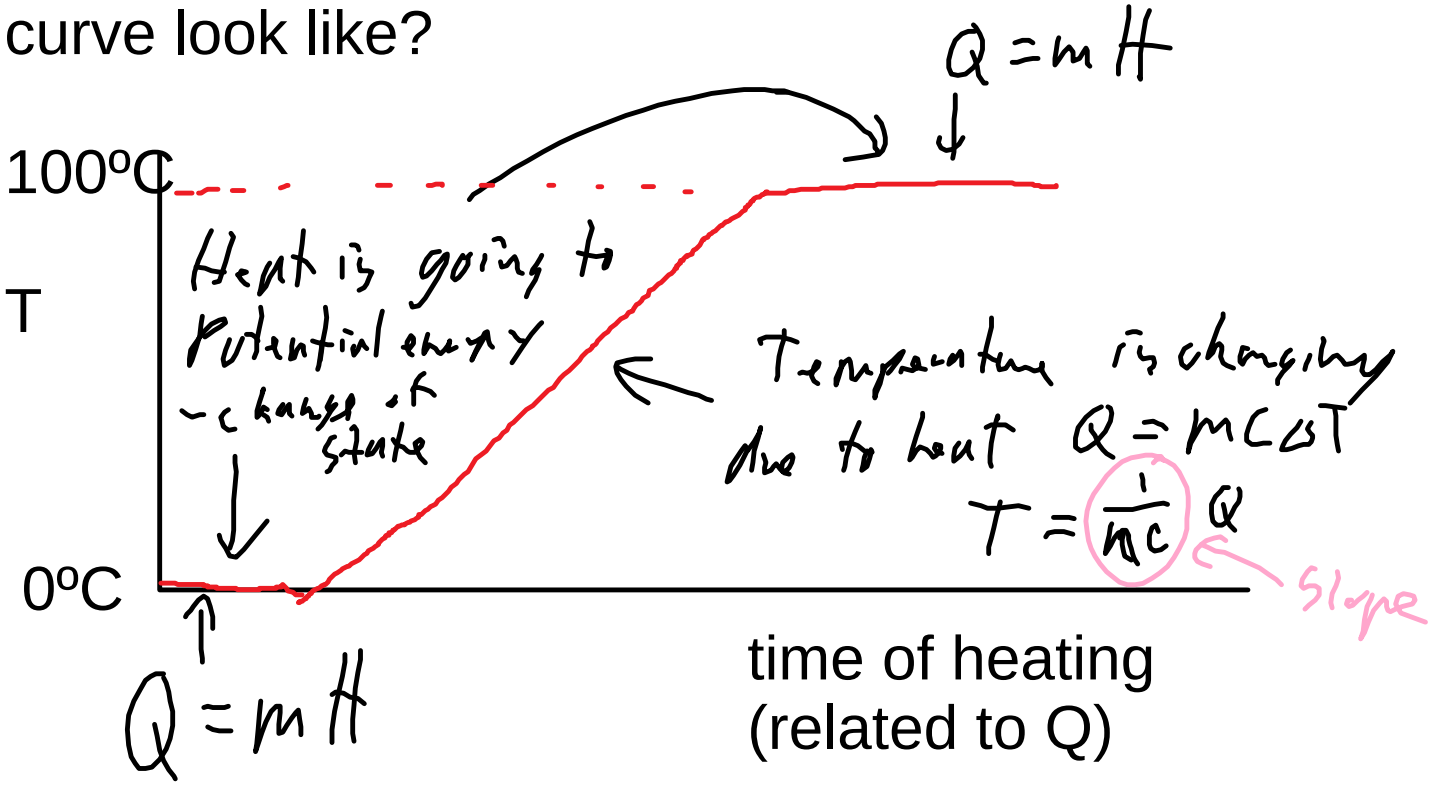
Temperature, T is the average kinetic energy of the particles of a substance.

When you heat ice water, what does the heating curve look like?



H is the latent heat, the heat required to change the state of the substance.

H_v is heat of vapourization, the heat to change from liquid to gas. For water $H_v=2.26x10^6$ J/kg p254

H_F is the heat of fusion, (fusion is another word for melting) for ice, it requires $3.34x10^5$J/kg to melt.

When the state changes the other way, that same amount of energy is given off.

When water freezes, it gives off energy and

when vapour condenses it gives off energy.

eg. How much energy is required for a 500g block of ice to

a) melt at 0.0ºC? $Q=mH_F$
   Q = 0.5x3.34E5=167,000 = 167kJ
b) warm from 0.0ºC to 100.0ºC? $Q=mc\Delta T$
   Q= 0.5x4180x(100-0)=209000 = 209kJ
c) vapourize at 100.0ºC? $Q=mH_v$
   Q = 0.5x2.26E6=1,130,000 = 1.13 MJ *
d) total energy used - add abc
   167+209+1130=1506 kJ = 1.51MJ
e) if the 500g block of ice is placed on a 10.0 kg block of iron at 500.0ºC, what will be the final temperature of the iron after the water has vapourized? (c_{iron} = 450J/kgºC) $-Q=mc\Delta T$
   - 1506000 = 10x450x(ΔT)
   ΔT= -1506000/4500=-334.6667
   T_f = 500-334.666=165.334 = 165ºC

Smarter than Einstein? How does the drinking duck work? (Monday)

p255 Q13-16 (assuming you have done Q1-12)

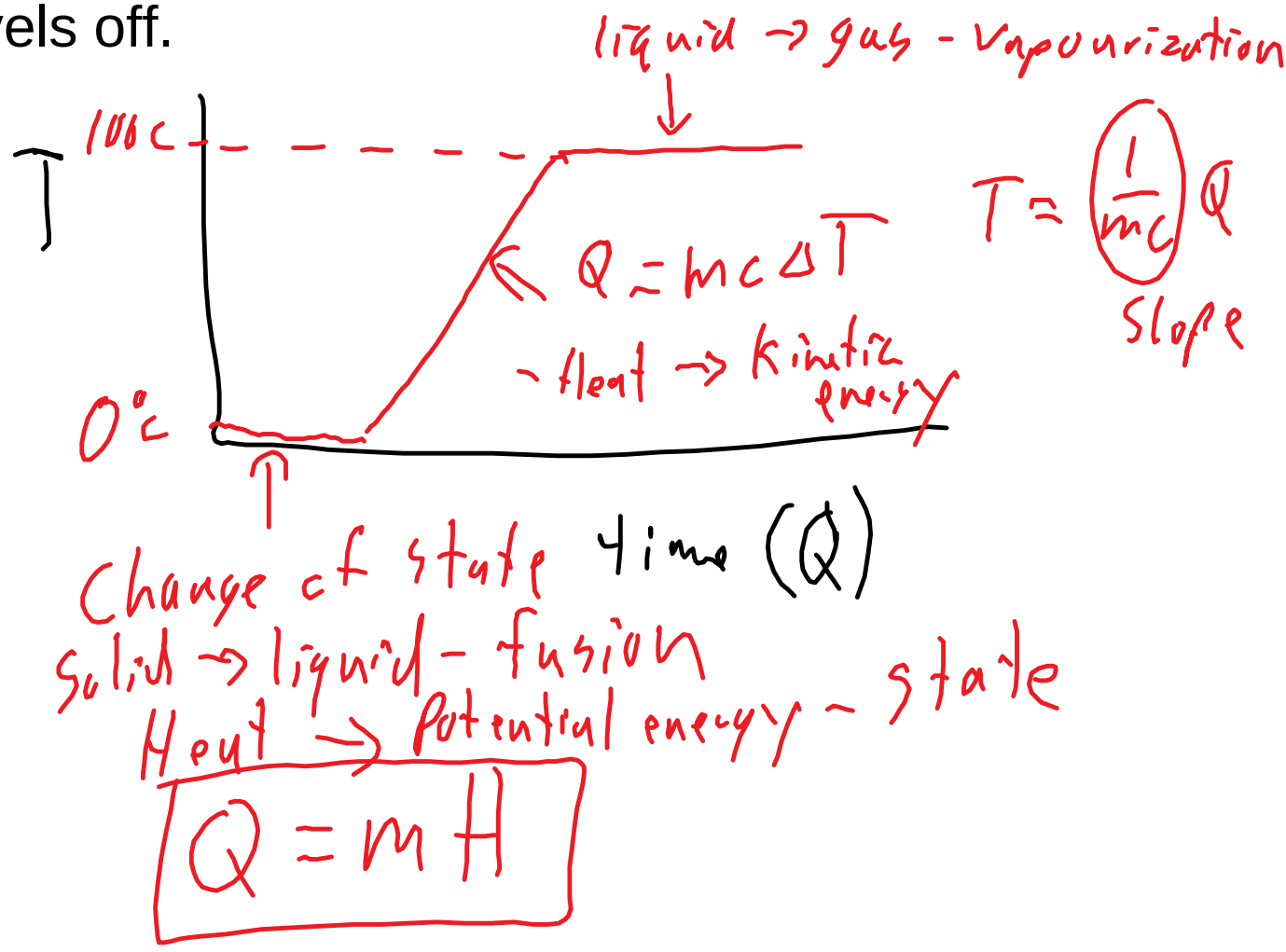
read the lab, p34

Block 2-4

Temperature, T is the average kinetic energy of the particles of a substance.

When you heat ice water, what does the heating curve look like?

It is flat for a bit (constant temperature) then a straightish line up to about 100ºC and then it levels off.



Q is the heat, in Joules, added to the material to change the state from solid to liquid or liquid to gas. It is also the heat removed to change from gas to liquid (condensation) or liquid to solid(solidification).

m is mass in kg.

H is Latent Heat - potential energy heat per unit

mass -
H_F is the heat of fusion - determined experimentally - found on table on p 254
water $H_F = 3.34 \times 10^5$ J/kg
H_v is the heat of vapourization - the heat to vapourize a liquid
water $H_v = 2.26 \times 10^6$ J/kg

eg. You put 500g of ice in a kettle and heat it from 0.0ºC to 100.0ºC and then completely vapourize it. how much heat is required to

a) melt 500g of ice completely? $Q=mH_F$
   $Q=mH = 0.5x3.34E5=167,000$ J =167kJ
b) heat the melted ice (water) from 0ºC to 100ºC?
   $Q=mc\Delta T$ $c=4180$J/kgºC
   $Q = 0.5x4180x(100-0)=209000$ J =209kJ
c) vapourize the water completely? $Q=mH_v$
   $Q= 0.5x2.26E6=1,130,000$ J = 1.13MJ
d) total energy of abc?
   167,000+209000+1,130,000=1506000 J
   = 1.51MJ
e) You put 500g of ice on 10.0 kg of iron (c= 450J/kgºC) at 500.0 ºC. If the ice was at 0ºC and completely vapourizes, what is the final temperature of the iron block? $-Q=mc\Delta T$
   $-1506000=10x450x\Delta T$
   $\Delta T = -1506000/4500=-334.6667$
   $T_f = 500-334.6667=165.3333 = 165$ºC

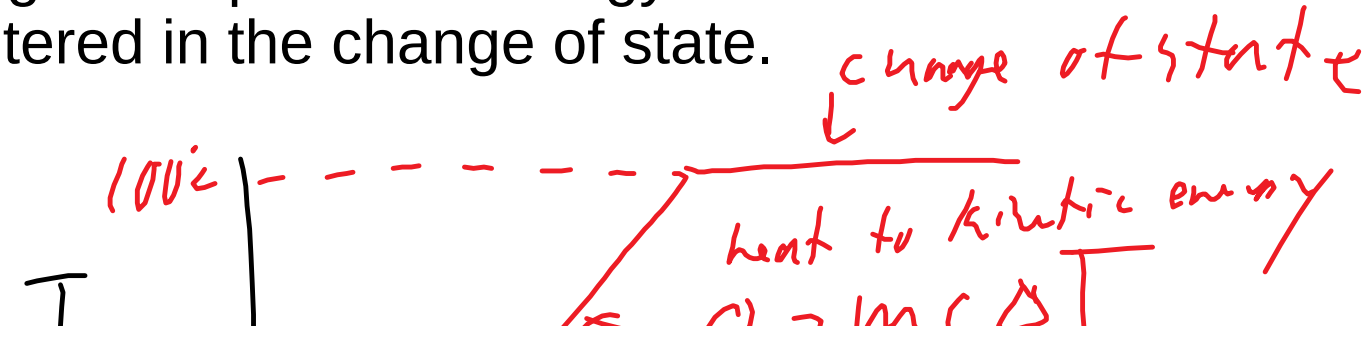
1. Figure out how the drinking bird works.
   Smarter than Einstein?
p255 Q13-16 (assuming you've done Q1-12)
Read the lab we do next class (p34 in labmanual)

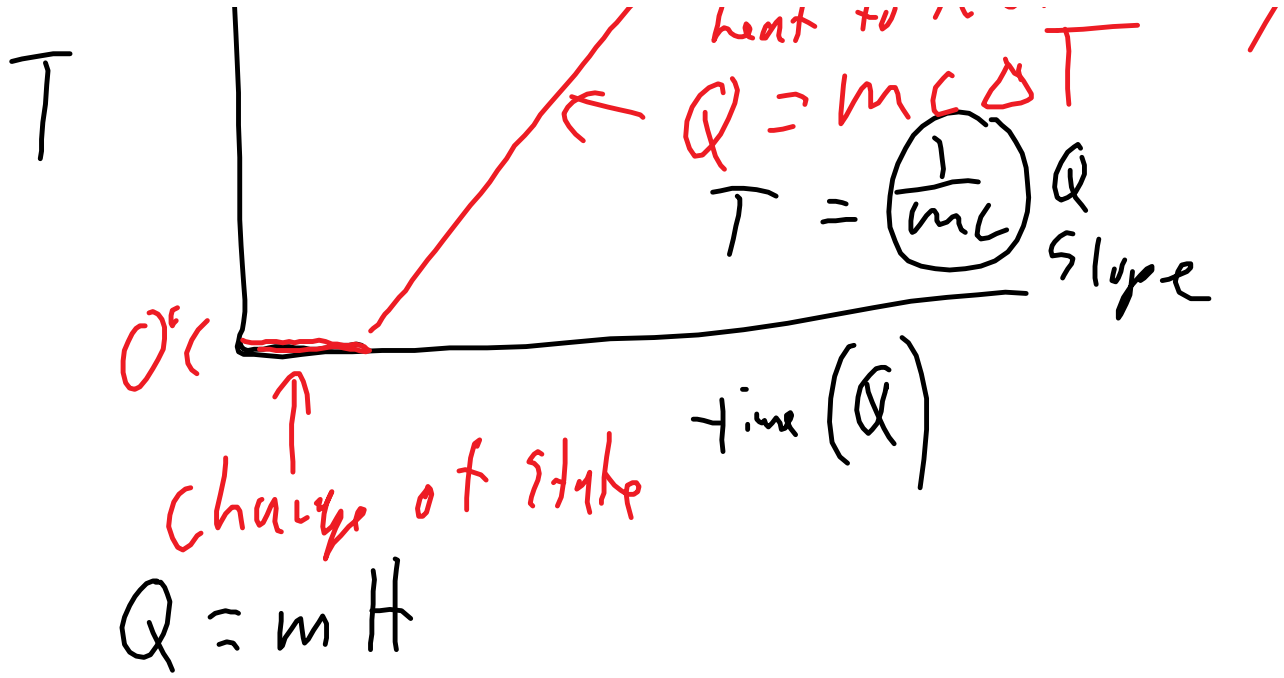
Block 2-3
Changes of State
Temperature, T, is average kinetic energy of the particles that make up a substance.

Heating Curve of Water
Put ice water into a kettle and heat it, measuring the temperature over time. The power of the kettle is 1200W, so the energy = Pt so the heat is proportional to the time.

In theory, the temperature is constant during the change of state (solid to liquid, then liquid to gas) even though you are adding energy. Where does the energy go if it doesn't go to kinetic energy(Temperature)?

It goes to potential energy - intermolecular bonds altered in the change of state.





Q is the heat required to change the state, in J. if you melt or vapourize, you put heat into the object. If you solidify (liquid to solid) or condense (gas to liquid) heat is given off from the object.

m is the mass of the object, in kg.

H is the latent heat of the object, you determine it experimentally and look it up on tables, p254.
H_F is the heat of fusion - to melt.
for ice, $H_F = 3.34 \times 10^5$ J/kg
H_v is the heat of vapourization, to change into gas. For water to steam, $H_v = 2.26 \times 10^6$ J/kg.

eg. You put 500g of ice in a kettle and heat it from 0.0ºC to 100.0ºC and then completely vapourize it. How much heat is required to

a) melt 500g of ice completely? $Q=mH_F$
   $Q = 0.5 \times 3.34E5 = 167{,}000$ J = 167kJ
b) heat the melted ice (water) from 0ºC to 100ºC?

b) heat the melted ice (water) from 0ºC to 100ºC?
$Q=mc\Delta T$ $c=4180J/kg^oC$
$Q = 0.5x4180x(100-0)=209000$ J = 209kJ

c) vapourize the water completely? $Q=mH_v$
$Q = 0.5x2.26E6=1,130,000$ J = 1.13MJ

d) total energy of abc?
167,000+209000+1,130,000=1506000 J
1.51MJ

e) You put 500g of ice on 10.0 kg of iron (c= 450J/kgºC) at 500.0 ºC. If the ice was at 0ºC and completely vapourizes, what is the final temperature of the iron block? $-Q=mc\Delta T$
$-1506000 = 10x450\Delta T$
$\Delta T = -1506000/4500=-334.6667$
$T_f = 500-334.66667=165.33333$
T_f = 165ºC

1. Figure out how the drinking bird works. Smarter than Einstein?

p255 Q13-16 (assuming you've done Q1-12)
Read the lab we do next class (p34 in labmanual)
Quiz Feb 22nd Ch 12